General

Guideline Title

Subaxial cervical spine injury classification systems. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

Bibliographic Source(s)

Aarabi B, Walters BC, Dhall SS, Gelb DE, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N, Hadley MN. Subaxial cervical spine injury classification systems. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):170-86. [65 references] PubMed

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

Recommendations

Level I

- The Subaxial Injury Classification (SLIC) and severity scale is recommended as a classification system for spinal cord injury. This system includes morphological, ligamentous, and neurological information in its scoring, thus communicating a greater amount of information regarding the extent of the patient's injury. Its overall inter-rater reliability has an intraclass correlation coefficient of 0.71.
- The Cervical Spine Injury Severity Score (CSISS) is recommended as a classification system for graded instability and fracture patterns in patients with spinal cord injury. Although there is excellent reliability (intraobserver and interobserver intraclass correlation coefficients for 15 reviewers were 0.977 and 0.883, respectively), the system is somewhat complicated, and its use may be limited to clinical trials rather than daily practice.

Level III

- The Harris classification of subaxial spinal injury is not recommended for describing the bony and soft tissue characteristics seen on imaging studies in spinal cord injury due to its low reliability (intra-class correlation coefficient of 0.42). It may be used in addition to more reliable measures for comparison to previous or other studies using this system.
- The Allen classification of subaxial spinal injury is not recommended for describing the mechanistic and imaging findings in cervical spine and

spinal cord injury due to its low reliability (intraclass correlation coefficient of 0.53). Fortunately, this classification system is not in widespread use.

Summary

The challenge confronting providers caring for patients with cervical spine traumatic injuries is how to quantify instability and create an algorithm of treatment in order to protect the spinal cord from further damage, prevent future spinal deformity and mitigate pain and discomfort. Biomechanical, cadaveric, and autopsy studies have confirmed the importance of ligamentous integrity of anterior and posterior cervical spine elements for smooth, effortless movements of cervical spine under physiological loads. Due to the lack of appropriate sectional imaging, previous investigators have resorted to major injury vectors (MIV) in order to construct descriptive mechanical classification of cervical spine injuries. However, these systems are complicated and difficult to use; their clinical relevance is not intuitive. In addition, their reliability is low, and they probably do not add value to clinical research on spinal cord injury. The only suggestion might be to use the Harris classification system in addition to a more reliable classification for comparison with previously reported studies using this older scheme.

Anatomical injury severity is one of the major independent variables that needs to be quantified for future therapeutic trials. Two partially validated classification systems, the SLIC and severity scale and the CSISS, have tried to scale and score injury severity, taking advantage of sectional imaging.

Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä statistic ≥0.60 or an intraclass correlation coefficient of ≥0.70
	Systematic review[b] of Class I randomized controlled trials (and study results were homogeneous[c])	Systematic review[b] of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective[d] comparative study[e]	Systematic review[b] of Class II studies	
	Systematic review[b] of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study[g]	Systematic review[b] of Class III studies	
	Retrospective[f] comparative study[e]	Case-control study	
	Systematic review[b] of Class II studies		
III	Case series[h]	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
	Expert opinion	Expert opinion	reliability is represented by a Ä statistic of <0.40 or an intraclass correlation coefficient of <0.50;

[a]A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

[b]A combination of results from 2 or more prior studies.

[c]Studies provided consistent results.

[d]Study was started before the first patient enrolled.

[e]Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

[f]The study was started after the first patient was enrolled.

[g]Patients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

[h]Patients treated 1 way with no comparison group of patients treated in another way.

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Subaxial cervical spine injury

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Neurological Surgery

Neurology

Orthopedic Surgery

Radiology

Intended Users

Physicians

Guideline Objective(s)

To provide an easy, reliable, and well-validated injury classification system for quantification of skeletal and ligamentous damage

Target Population

Patients with subaxial cervical spine injury

Interventions and Practices Considered

Classification of subaxial cervical spine injury severity using the following systems:

- Subaxial Injury Classification (SLIC) and severity scale
- Cervical Spine Injury Severity Score (CSISS)
- Harris classification of subaxial spinal injury
- Allen classification of subaxial spinal injury (not recommended)

Major Outcomes Considered

Ease of use, reliability, and validity of mechanistic classification strategies

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search Criteria

A computerized search of the National Library of Medicine (PubMed) database of English literature published from 1966 to 2011 was performed focusing on human studies and subaxial cervical spine injury classification systems using MEDLINE medical subject headings and keywords "cervical spine trauma," "cervical spine injury," "cervical spine injury classification," and "subaxial cervical spine injury." Approximately 28,500 citations were obtained. Additional search terms "Cervical Spine Injury Classification" resulted in 593 citations, "lower cervical spine injury

classification" resulted in 87 citations, and "subaxial cervical spine injury classification" resulted in 25 citations. Titles and abstracts of these 112 manuscripts were reviewed. Additional publications were cross-referenced from the citation lists of these papers. Finally, the members of the author groups were asked to contribute articles known to them on the subject matter that were not found by other search means. Duplications, case reports, pharmacokinetic reports, general reviews, editorials, and critiques were excluded.

Number of Source Documents

Twenty-one manuscripts were fully reviewed and contributed to the topic of subaxial cervical spine injury classification systems, 4 of which contributed to the formulation of recommendations and are summarized in Evidentiary Table format (see Table 3 in the original guideline document).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

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III	Case series[h]	Poor reference standard	Evidence provided by 1 or more well-designed clinical

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
			studies in which interobserver and intraobserver reliability is represented by a κ statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

[a]A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

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Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to Table 3 in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

An easy, reliable, and well-validated injury classification system for quantification of skeletal and ligamentous damage may help with communication, management, prognostication, and research in the field of subaxial cervical spine injuries.

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not

absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.

- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Mar

Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

Congress of Neurological Surgeons

Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the Neurosurgery Web site [   ].

Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the Neurosurgery Web site [   ].

- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the Neurosurgery Web site [   ].
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the Neurosurgery Web site [   ].
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the Neurosurgery Web site [   ].

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

Copyright Statement

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